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L16: Entry 1 of 1

File: USPT

Sep 11, 1990

DOCUMENT-IDENTIFIER: US 4956777 A

TITLE: Automatic vehicle control system

Abstract Paragraph Left (1):

The system includes a first computer for communicating with automatic guided vehicles on a guided vehicle loop and storing information related to vehicle position. A second computer determines vehicle destinations. The first computer and the second computer maintain separate databases. Information in the data of the first computer relating to vehicle position is copied into the database of the second computer to assist in making vehicle destination determinations and the vehicle destination information stored in the database of the second computer is copied into the first computer. The invention also includes a unique fast and slow polling routine to insure that data transfer to the vehicles requiring it most is achieved in any polling cycle.

Brief Summary Paragraph Right (15):

In accordance with the above and other objects, the present invention comprises a system including a plurality of guided vehicles operating along a guided vehicle path. A plurality of indicators is positioned along the path for indicating to the vehicles their position on the path. A guided vehicle controller is provided and includes a communication system for communicating with the guided vehicles. A first computer system exchanges information with the guided vehicles through the communication system and includes a first memory section for storing information received from the vehicles including position data of each vehicle in relation to the indicators. A second memory section is included for storing information to be transmitted to the vehicles including vehicle destinations or vehicle destination information. A second computer system provided is for receiving vehicle movement requests from external sources and determining which vehicles are to respond to the requests. The second computer system includes a third memory section for storing information relating to vehicle positions, i.e. vehicle position data in relation to the position indicators. A fourth memory section is provided for storing information including vehicle destination information. A first transfer system copies the information in the first memory section to the third memory section so that the first and third memory sections contain the same vehicle position information and a second transfer systems copies the information in the fourth memory section to the second memory section so that the fourth and second memory sections contain the same vehicle destination information.

Drawing Description Paragraph Right (4):

FIG. 3 is a flow diagram showing the flow of data during the data transfer taking place in the controller of FIG. 2;

Detailed Description Paragraph Right (1):

FIG. 1 shows a typical prior art vehicle controller configuration for an automated guide vehicle system. In FIG. an automated guided vehicle management system 10 manages information flow between various stations of a manufacturing facility relating to the movement of raw materials, waste, rejects and/or finished goods by automated guided vehicles. The vehicle management system 10 may serve many functions within the plant and may operate as a host computer for an administration and traffic control computer system 12. The vehicle management system 10 will transmit to the administration and traffic control, system 12 specific vehicle movement

requests asking that certain materials be transported by guided vehicle to a specific location or that certain finished goods be removed from a particular location and transported to a certain destination. The flow of commands from the management system 10 to the administration and control system 12 is indicated at 14. These commands are general in nature indicating only that particular materials are to be picked up at one location and dropped off at another location. The administration and traffic control system 12 determines which vehicles are available for particular jobs, maintains status information on each vehicle and actually controls the movements of various vehicles through modems 16 and 18. Communication with the odd numbered automated guided vehicles (AGVs) 20 is carried out through modem 16 whereas commands to and data from the even numbered AGVs 22 are channeled through modem 18.

Detailed Description Paragraph Right (5):

Furthermore, a vehicle controller subsystem is provided on each automatic guided vehicle 20-22 and is linked to the traffic controller through an on board, full duplex data transmitter. This link enables each vehicle to maintain real time constant communication with the traffic controller software through modems 16 and 18. The vehicle controller also controls the vehicle speed and acceleration, monitors safety subsystems, controls steering and route optimization, operates load transfer equipment, monitors vehicle operations and systems, and aids in vehicle testing and diagnosis.

Detailed Description Paragraph Right (9):

FIG. 3 shows more clearly the data transfer which takes place in the system of the present invention. In FIG. 3, it is assumed that computers 30 and 32 are active and computers 36 and 38 act as hot backups. It will be understood, of course, that either computer 30 or 36 can be designated as the active computer with the other being a backup. Likewise either the computer 32 or computer 38 can be designated active with the other being designated backup. In each case, the active and backup computers run exactly the same software and continuously operate so that a transfer between active and backup computers can take place at any time without any information being lost or any control system down time being necessary.

Detailed Description Paragraph Right (12):

The data above including vehicle destination information in database 30' must be transferred to data base 32' to database 36' and to database 38'. This is accomplished by a transfer routine 50 which may be written in Fortran or any other convenient language. This is a conventional type of routine which simply copies each desired data element into an intermediate database 52. Database 52 is a temporary database which is written in accordance with the language CRISP. CRISP is a software system sold by CRISP Automation, a division of Joy Technology, and includes a networking capability referred to as CRISPNET. It will be understood that other types of networks could be used equally as well for transferring the data. Database 52 is a CRISP database stored in RAM. The transfer program 50 insures that database 52 contains all of the data to be transferred from database 30 to the other databases. Through the CRISPNET link, the data from database 52 is transferred to a CRISP database 54, to a CI:ISP data base 56 and to a CRISP database 58 using a token ring system. The data in database 54 is transferred to database 32' of computer 32 using a second transfer program 60 which is identical to transfer program 50. Transfer program 60 is run on computer 32 to complete the data transfer in this area. Similarly, a transfer program 70 run on computer 38 transfers the data from database 56 into database 38'. Finally, a transfer program 80 transfers the data in database 58 to database 36'. In this manner, all of the data is transferred to the memory of each computer requiring it so that duplicates of the data are contained in every computer. This allows the computers 30 and 32 to operate on the same data so that the two computers essentially function as one.

Detailed Description Paragraph Right (14):

The above data is stored in active database 32' and transferred out by transfer program 60 to CRISP database 62'. From the CRISP database 62, the CRISPNET link is used to transfer the data to CRISP database 64 and then to database 30' using transfer program 50. Similarly, the data in database 62 is transferred to database 66 and then to database 36' using transfer program 80. Likewise, the data is transferred to database 68 and then to database 38 through data transfer program 70.

Detailed Description Paragraph Right (15):

The data transfers are initiated at one second intervals. This provides a constant updating of the data in all of the databases so that the same data is available wherever it is needed. This allows the computers to function as a single system using a single database but with more flexibility and with the ability to control a greater number of vehicles.

Detailed Description Paragraph Right (16):

It will be noted that according to the present data transfer scheme, the data in active database 30' is transferred to inactive database 36'. Inactive computer 36 receives all the same inputs as active computer 30 and could generate its own database. However, it has been found preferable to simply transfer the data through data transfer calls to insure that the data in database 36' is a duplicate of the data in database 30'

Detailed Description Paragraph Right (17):

It is also noted that the data transfer paths from active computer to active computer are shown in solid line whereas the data transfer paths from an active computer to a backup computer are shown in dotted lines. Similar data transfer paths are established regardless of which computers are active and which computers act as backup computers.

CLAIMS:

1. A system, comprising:

a guided vehicle path;

a plurality of guided vehicles operating along said path;

a plurality of indicators positioned along said path for indicating to said vehicles position on said path; and

a guided vehicle controller, comprising:

means for communicating with said guided vehicles;

a first computer system for exchanging information with said guided vehicles through said communicating means, said first computer system including a first memory section for storing information received from said vehicles including vehicle position information of each vehicle in relation to said indicators and including a second memory section for storing information to be transmitted to said vehicles including vehicle destination information;

a second computer system for receiving vehicle movement requests from external sources and determining which vehicles are to respond to said requests, said second computer system including a third memory section for storing information relating to vehicle position in relation to said indicators and including a fourth memory section for storing information including vehicle destination information;

first transfer means for copying said information in said first memory section to said third memory section so that said first memory section and said third memory section contain the same vehicle position information; and

second transfer means for copying said information in said fourth memory section to said second memory section so that said fourth memory section and said second memory section contain the same vehicle destination information.

4. A system as claimed in claim 1 wherein said guided vehicle controller further includes a third computer system for backing up said first computer system, said third computer system having a fifth memory section for storing said vehicle position information and a sixth memory section for storing said vehicle destination information, and a fourth computer system for backing up said second computer

system, said fourth computer system having a seventh memory section for storing said vehicle position information and an eight memory section for storing said vehicle destination information and said first transfer means includes means for copying said vehicle position information to said fifth memory section and to said seventh memory section, and said second transfer means includes means for copying said vehicle destination information to said sixth memory section and to said eighth memory section.

9. A system, comprising:

a guided vehicle path;

a plurality of guided vehicles operating along said path;

a plurality of indicators positioned along said path for indicating to said vehicles position on said path; and

a guided vehicle controller, comprising:

means for communicating with said guided vehicles;

a first computer system for exchanging information with said guided vehicles through said communicating means, said first computer system including a first memory section for storing information received from said vehicles including vehicle position information of each vehicle in relation to said indicators and including a second memory section for storing information to be transmitted to said vehicles including vehicle destination information;

a second computer system for receiving vehicle movement requests from external sources and determining which vehicles are to respond to said requests, said second computer system including a third memory section for storing information relating to vehicle position in relation to said indicators and including a fourth memory section for storing information including vehicle destination information;

first transfer means for copying said information in said first memory section to said third memory section so that said first memory section and said third memory section contain the same vehicle position information; and

second transfer means for copying said information in said fourth memory section to said second memory section so that said fourth memory section and said second memory section contain the same vehicle destination information;

wherein said first computer system polls said vehicles using a fast polling routine for vehicles within a first predetermined distance of a next position indicator and using a slow polling routine after the fast polling routine is completed, and wherein said fast polling routine includes requesting information from each vehicle as to its position, storing said requested fast polling position information in said first memory section and indicating to each fast polled vehicle whether it should stop or continue

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<input type="checkbox"/>	<u>4284160</u>	August 1981	DeLiban et al.	180/168
<input type="checkbox"/>	<u>4361202</u>	November 1982	Minovitch	364/424.02
<input type="checkbox"/>	<u>4630216</u>	December 1986	Tyler et al.	180/168
<input type="checkbox"/>	<u>4780817</u>	October 1988	Lofgren	180/168
<input type="checkbox"/>	<u>4791570</u>	December 1988	Sherman et al.	364/424.02

OTHER PUBLICATIONS

"A Distributed System for Digital Signal Processing and Computation for Automated Vehicle Guidance", by Goddard et al., IEEC & E, Oct. 1981.

ART-UNIT: 234

PRIMARY-EXAMINER: Chin; Gary

ATTY-AGENT-FIRM: Myers; Grover M.

ABSTRACT:

The system includes a first computer for communicating with automatic guided vehicles on a guided vehicle loop and storing information related to vehicle position. A second computer determines vehicle destinations. The first computer and the second computer maintain separate databases. Information in the data of the first computer relating to vehicle position is copied into the database of the second computer to assist in making vehicle destination determinations and the vehicle destination information stored in the database of the second computer is copied into the first computer. The invention also includes a unique fast and slow polling routine to insure that data transfer to the vehicles requiring it most is achieved in any polling cycle.

19 Claims, 6 Drawing figures